REMARKS/ARGUMENTS

Favorable reconsideration of this application as currently amended and in view of the following remarks is respectfully requested.

Claims 1, 2, 5-7, 10, and 12-18 are currently active in this case. Claim 8 has been cancelled, and claims 1, 7, 10, and 15 have been amended by the current amendment. No new matter has been added.

In the outstanding Office Action, claim 7 was rejected under 35 U.S.C. 102(b) as anticipated by Tanabe et al.; and claims 1, 2, 5, 6, 10, 12, 13, 15, and 18 were rejected under 35 U.S.C. 103(a) as unpatentable over Tanabe et al. in view of JP Publication 2002-287190 (JP '190).

By way of background, the terahertz band is called the "black band of the electromagnetic wave," and the terahertz band spanning from 0.5 to 10 THz has most recently been under development. There are still many unknown physical parameters of the materials to be used in the terahertz band because there is no sufficient wide band frequency-tunable electromagnetic wave generator to study the physical parameters of the materials. One objective of the present invention is to provide a wide band frequency-tunable electromagnetic wave generator in a terahertz band spanning from 0.5 to 7 THz, capable of emitting high output, facilitating a high capability of substance identification, and sweapable without mode-hop. To that end, the claimed electromagnetic wave generator encompasses a first pump beam emitter including a first pump source implemented by a first Cr-doped forsterite laser and a second pump beam emitter including a second pump source implemented by a second Cr-doped forsterite laser, the wavelength of which is different from the wavelength of the first pump Cr-doped forsterite laser.

In particular, the claimed first and second Cr-doped forsterite lasers emit a frequency-tunable terahertz electromagnetic wave, tunable over a wide frequency band spanning from 0.5 to 7 THz.

Turning now to Tanabe et al., there is no disclosure or suggestion of the combination of the claimed first and second Cr-doped forsterite lasers. Furthermore, Tanabe et al. fail to show the claimed angle control mechanism configured to rotate the nonlinear optical crystal so as to control an angle of the electromagnetic wave exit face against an optical axis of the first pump beam. As claimed, the electromagnetic wave generator is tunable over a wide frequency band spanning from 0.5 to 7 THz. When the frequency of the emitted terahertz electromagnetic wave reaches a higher frequency, such as approximately 3-4 THz, the terahertz electromagnetic wave suffers from total internal reflection at the electromagnetic wave exit face or the back face of the nonlinear optical crystal. In order to avoid the total internal reflection, as shown in Fig. 14 of the Specification, the nonlinear optical crystal 19 is mounted on the crystal rotation stage 57 so that the nonlinear optical crystal 19 can be rotated as needed, and total internal reflection is prevented at the electromagnetic wave exit face at higher frequencies in the present invention.[1] It is evident from Tanabe et al. that a person of ordinary skill in the art would not have had a reason to employ the claimed angle control mechanism because the frequency band of Tanabe et al. is so narrow at 0.5 to 3THz that the terahertz electromagnetic wave would not suffer from the total internal reflection problem. See abstract, section V, paragraph I.

JP '190 fails to address the deficiencies of Tanabe et al. JP '190 merely discloses a Cr-doped forsterite laser 14 and an Nd: YAG laser 12 which emit infrared lights having wavelengths of 5-14 micrometers. See claims 2 and 3 and paragraphs [0011], [0016], [0017], and [0031] of JP '190. The wavelengths of 5-14 micrometers correspond to 21.4-60 THz.

[1] This example is intended to be non-limiting.

Further, none of the Tanabe et al. references of record cure the deficiencies of the primary Tanabe et al. reference because those references fail to show the claimed angle control mechanism feature.

Applicants respectfully submit that the mere fact JP '190 discloses the combination of the Cr-doped forsterite laser 14 and the Nd: YAG laser 12 does not automatically mean that a person of ordinary skill in the art would have combined the claimed first and second Cr-doped forsterite lasers in order to emit the frequency-tunable terahertz electromagnetic wave, which is tunable over a wide frequency band spanning from 0.5 to 7 THz. Because there are many unknown physical parameters of the materials and components used in the terahertz band spanning from 0.5 to 7 THz, in order to arrange the claimed electromagneticwave generator having a first pump beam emitter including a first pump source implemented by a first Cr-doped forsterite laser and a second pump beam emitter including a second pump source implemented by a second Cr-doped forsterite laser, very difficult, complicated and time consuming experiments are needed.

Furthermore, it is very difficult to have two Cr-doped forsterite lasers (i.e., the claimed first and second Cr-doped forsterite lasers) with perfectly identical and stable characteristics. The characteristics of Cr-doped forsterite lasers vary product to product. For example, because two Cr-doped forsterite lasers sometimes have different delay times at the beginning of oscillation (See page 39, line 4-9), and the delay time depends on the oscillation wavelength, prior to the present invention it was uncertain whether the combination of the claimed first and second Cr-doped forsterite lasers would actually work well so as to emit the frequency-tunable terahertz electromagnetic wave of 0.5 to 7 THz.

As shown in Fig.3 of Tanabe et al., theoretical prediction differs from experimental data in the terahertz band, and unknown physical parameters mutually affect each other. Thus, a person of ordinary skill in the art would not have had a reasonable likelihood of

success that the claimed combination of two Cr-doped forsterite lasers would work in light of Tanabe et al.

In view of the foregoing, the rejection of Claims 1, 2, 5-6, 10, 12-13, 15 and 18 under 35 U.S.C. § 103(a) in view of the combination of Tanabe et al. and JP '190 is respectfully requested to be withdrawn.

In light of the above discussion and in view of the present amendments, the present application is believed to be in condition for formal allowance. An early and favorable action is respectfully requested.

Respectfully submitted,

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